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JP9-289162
English translation
(1-4)

[TITLE OF THE INVENTION]

TEMPERATURE ADJUSTING APPARATUS

[Abstract]

[Problem to be Solved]

A problem to be solved by the present invention is to substantially uniformly adjust the temperature of a substrate, thereby achieving a uniform process.

[Solving Means]

A semiconductor wafer 104 is supported by three support members 102 disposed in the vicinity of the peripheral portion of a temperature adjuster 101, followed by heating treatment. The support member 102 consists of an embedded portion 102a embedded in the temperature adjuster 101 and a projecting portion 102b disposed at the center of the embedded portion 102a. Since the semiconductor wafer 104 is placed on the projecting portions 102b, it is heated at a high temperature via the projecting portions 102b, but other portions are uniformly heated, and further, the heating treatment can be achieved without any pollution.

[SCOPE OF CLAIM FOR A PATENT]

[Claim 1]

A temperature adjusting apparatus comprising:

a temperature adjuster capable of setting temperature to a predetermined value; and

a plurality of support members for supporting a member to be adjusted in temperature and holding the member to be adjusted in temperature in a manner out of contact with the temperature adjuster, each of the support members including an embedded portion which is embedded in the temperature adjuster and a projecting portion which projects from the surface of the temperature adjuster.

[Claim 2]

The temperature adjusting apparatus according to Claim 1, wherein the support members are arranged at such positions as to support the peripheral edge of the member to be adjusted in temperature.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical Field to which the Invention Pertains]

The present invention relates to a temperature adjusting apparatus for adjusting the temperature of a substrate such as a semiconductor wafer or a substrate for a liquid crystal display (LCD).

[0002]

[Prior Art]

Various kinds of heating apparatuses have been conventionally used for subjecting a substrate such as a

semiconductor wafer or a glass substrate for an LCD to heating treatment. For example, in a photo resist process among semiconductor fabricating processes, the heating treatment is performed in order to remove water from the surface of the semiconductor wafer or remove a solvent contained in resist applied onto the surface of the wafer. Examples of heating methods include a direct hot plate system, a batch type hot air heating system, a microwave system and the like. Among them, the direct hot plate system has become mainstream from demands for compactness, efficiency, reduction of a cycle time and enhancing reproducibility or uniformity.

[0003]

However, since the semiconductor wafer is directly heated in close contact with a hot plate in the direct hot plate system, the close contact state between the hot plate and the semiconductor wafer markedly influences on the uniformity of heat. Otherwise, since the hot plate is generally made of metal such as aluminum, there has arisen a problem of heavy-metals pollution or adhesion of particles to the reverse of the semiconductor wafer.

[0004]

In order to solve the above-described problem, there has been devised a proximity system, in which a fine gap is formed between a hot plate and a semiconductor wafer, and

then, heating treatment is performed without bringing the semiconductor wafer into direct contact with the hot plate. Such a heating apparatus of a proximity system is provided with a hot plate 701 having a heater incorporated therein, as shown in Figs. 6 and 7. Three rectangular recesses 705 are formed near the center of the hot plate 701. A substrate supporting ball 702 made of ceramic is contained in each of the recesses 705 in such a manner as to slightly project from the upper surface of the hot plate 701. Furthermore, holes 703 for allowing substrate supporting pins (not shown) to be inserted or drawn therethrough are provided near the center of the hot plate 701 so as to place a semiconductor wafer 704 on the hot plate 701 or carry out the semiconductor wafer 704 from the hot plate 701.

[0005]

In the heating apparatus such configured as described above, first, the substrate supporting pins are allowed to project above the hot plate 701 through the holes 703 for the supporting pins, and thereafter, the semiconductor wafer 704 is placed on the substrate supporting pins. Subsequently, the substrate supporting pins are contained in the lower portion of the hot plate 701, so that the semiconductor wafer 704 is placed on the balls 702, followed by heating treatment. At this time, since the

balls 702 slightly project from the upper surface of the hot plate 701, that is to say, the fine gap is formed between the semiconductor wafer 704 and the hot plate 701, no particle pollution or the like can occur at the semiconductor wafer 704 or the semiconductor wafer 704 can be efficiently heated.

[0006]

[Problems to be Solved by the Invention]

Here, since the ball 702 is contained in the recess 705 in a not-fixed manner, the ball 702 may be accidentally drawn or floated out of the recess 705 when the hot plate 701 is cleaned or the semiconductor wafer 704 is detached. In this state, if the semiconductor wafer 704 is placed on the balls 702, the semiconductor wafer 704 is inclined with respect to the upper surface of the hot plate 701, thereby arising a problem of non-uniformity of the heating.

[0007]

Moreover, in the above-described substrate heating apparatus, the balls 702 are arranged near the center of the hot plate 701. Since the semiconductor wafer 704 is brought into contact with the hot plate 701 via the balls 702, the center and thereabouts are strongly heated more than other portions. Therefore, there has arisen a problem of non-uniform temperature distribution within the surface of the semiconductor wafer 704. In particular, if the

temperature of a portion corresponding to a resist pattern rises too high in the case of post-baking for hardening the resist pattern, there has arisen a problem of a partly change in thickness or shape of the resist pattern.

[0008]

An object of the present invention is to provide a temperature adjusting apparatus which can uniformly adjust the temperature of a substrate requiring heating treatment such as a semiconductor wafer or an LCD. Furthermore, another object of the present invention is to provide a temperature adjusting apparatus capable of adjusting the temperature of a substrate in a substantially uniform manner in consideration that an integrated circuit (abbreviated as an IC) formed on the semiconductor wafer 704 is normally formed over the entire surface of the semiconductor wafer 704 except for the peripheral edge thereof and a main portion to be heated inherently uniformly such as a resist pattern is located at a portion except for the peripheral edge.

[0009]

[Means for Solving the Problems]

In order to achieve the above-described objects, a temperature adjusting apparatus according to the present invention comprises: a temperature adjuster capable of setting temperature to a predetermined value; and a

plurality of support members for supporting a member to be adjusted in temperature and holding the member to be adjusted in temperature in a manner out of contact with the temperature adjuster, wherein each of the support members includes an embedded portion which is embedded in the temperature adjuster and a projecting portion which projects from the surface of the temperature adjuster. Preferably, the support members are arranged at such positions as to support the peripheral edge of the member to be adjusted in temperature.

[0010]

Since the embedded portion is embedded in the temperature adjuster, the support member cannot be drawn or floated from the temperature adjuster. Consequently, the member to be adjusted in temperature, supported by the support members, cannot be inclined, thus can be uniformly adjusted in temperature. Furthermore, the member to be adjusted in temperature is supported at the peripheral edge thereof by the plurality of the support members, to be thus adjusted in temperature in a substantially uniform manner.

[0011]

[Preferred Embodiments]

Referring to the drawings, a description will be given of one preferred embodiment in which a heating adjusting apparatus according to the present invention is

applied to a substrate heating apparatus for use in heating treatment such as adhesion treatment, pre-baking treatment or post-baking treatment for a semiconductor wafer. As shown in Figs. 1 and 2, the substrate heating apparatus includes a circular temperature adjuster 101, which incorporates therein a heating member (not shown) capable of adjusting the heating temperature such as an electric heater. Here, the heating temperature and time of the temperature adjuster 101 can be variously set according to the object of the treatment. For example, in the case of the adhesion treatment, the heating is performed at a temperature ranging from about 80 °C to 100 °C for about 30 seconds; in the case of the pre-baking treatment, the heating is performed at a temperature ranging from about 120 °C to 150 °C for 1 minute; in the case of the post-baking treatment, the heating is performed at a temperature ranging from about 120 °C to 150 °C for about 1 minute; in the case of cooling treatment, the temperature is controlled to stay at room temperature (for example, 23 °C). The temperature adjuster 101 includes holes 103 for allowing substrate supporting pins (not shown) to be inserted or drawn therethrough, which are used in placing a semiconductor wafer 104 as a member to be adjusted in temperature on the temperature adjuster 101 or carrying out the semiconductor wafer 104 from the temperature adjuster

101.

[0012]

At the peripheral edge of the above-described temperature adjuster 101 are provided three support members 102 for supporting the semiconductor wafer 104. The support member 102 is preferably made of ceramic or the like since it is adapted to prevent any pollution of the reverse of the semiconductor wafer 104. As shown in Figs. 3 and 4, the support member 102 consists of a disk-like embedded portion 102a and a projecting portion 102b projecting from the center of the disk-like embedded portion 102a.

[0013]

In the meantime, in the temperature adjuster 101, recesses 403 serving as containing portions are formed at positions opposite to the peripheral edge of the semiconductor wafer 104 placed above the temperature adjuster 101. The disk-like embedded portion 102a of the support member 102 is contained inside of the recess 403, and then, is fixed via a screw nut 402 screwed with a screw portion 404 disposed on the side wall of the recess 403. The tip of the projecting portion 102b projects from the upper surface of the temperature adjuster 101 by about 0.1 mm to 0.3 mm. Consequently, a gap is held by a projecting length of the tip of the projecting portion 102b between

the semiconductor wafer 104 placed on the projecting portions 102b and the temperature adjuster 101. Incidentally, the support member 102 may be fixed not by screwing the screw nut 402 but by press-fitting a ring-like member made of a resin material such as PTFE into the recess.

[0014]

Furthermore, as shown in Fig. 5, a recess 403a to be formed in the temperature adjuster 101 is formed in such a manner as to loosely engage with the embedded portion 102a of the support member 102. The recess 403 is merely formed in such a size as to absorb a difference in expanding volume at the time of heating caused by a difference in expansion coefficient between a material for forming the temperature adjuster 101 and a material for forming the support member 102. After the embedded portion 102a of the support member 102 is contained in the recess 403, the support member 102 can be fixed via the screw portion 404 and the screw nut 402 disposed on the side wall of the recess 403, as described above. Here, a hole, which is formed at the screw nut so as to allow the projecting portion 102b of the support member 102 to be inserted therethrough, may be formed in outer diameter greater than the projecting portion 102b, so as to loosely engage with the projecting portion 102b.

[0015]

Moreover, in order to fix the support member 102, a disk-like cover 402a may be disposed in such a manner as to cover not only the recess 403a, but also the entire surface of the temperature adjuster 101, and a hole, which allows the tip of the projecting portion 102b to project in loose engagement, may be formed at a position corresponding to each of the projecting portions 102b, so that the cover is fixed to the temperature adjuster 101. The loose engagement of the support member 102 can prevent any damage on the support member 102 due to a difference in volume increase between the temperature adjuster 101 and the support member 102 at the time of heating caused by a difference in expansion coefficient.

[0016]

Explanation will be made below on operation of the substrate heating apparatus configured as described above. The semiconductor wafer 104, which is carried out of a processor such as a sender for sending out the semiconductor wafer before the treatment or a coater for applying photo resist to the semiconductor wafer, is first placed on the three substrate supporting pins projecting above the temperature adjuster 101 via the holes 103 for the supporting pins by a carrying mechanism (not shown).

[0017]

Subsequently, each of the substrate supporting pins is contained in the lower portion of the temperature adjuster 101, and therefore, the semiconductor wafer 104 is placed on the projecting portions 102b of the support members 102. In this state, the semiconductor wafer 104 is heated by the electric heater incorporated in the temperature adjuster. As described above, the heating temperature and time are variously set according to the kind of treatment. Since the tip of the projecting portion 102b projects by about 0.1 mm to 0.3 mm from the upper surface of the temperature adjuster 101, namely, since the gap is formed in about 0.1 mm to 0.3 mm between the semiconductor wafer 104 and the temperature adjuster 101, no particle pollution or the like can occur in the semiconductor wafer 104, thus efficiently heating the semiconductor wafer 104.

[0018]

At this time, each of the support members 102 is arranged in the vicinity of the peripheral edge of the temperature adjuster 101, so that the semiconductor wafer 104 is supported in the vicinity of the edge thereof by each of the support members 102. As a consequence, the portion close to the support member 102 at the periphery of the semiconductor wafer 104 is heated at a temperature higher than those at other portions. However, since the IC

is disposed inside of the edge of the semiconductor wafer 104, the portion at which the IC is disposed is uniformly heated by radiant heat or the like from a heating table, and therefore, the semiconductor wafer 104 can be substantially uniformly heated.

[0019]

The semiconductor wafer 104 heated as described above is detached from the temperature adjuster 101 when the substrate supporting pins project from the holes 103 for the supporting pins above the temperature adjuster 101, and thereafter, is carried to a next process. Additionally, as shown in Fig. 6 which is a view showing another preferred embodiment according to the present invention, another supporting member 102 may be disposed also at the center of the temperature adjuster 101. Incidentally, it is preferable from the viewpoint of prevention of particle adhesion or achievement of uniform heating that the tip of the supporting member 102, that is, a portion which contact with the semiconductor wafer 104 should be formed as thinly as possible.

[0020]

If the diameter of the semiconductor wafer 104 becomes as large as, for example, about 8 inch, the semiconductor wafer 104 is warped so that the center of the semiconductor wafer 104 is brought into contact with the

temperature adjuster 101 with a fear of pollution due to particles or the like in the case where only the vicinity of the edge of the semiconductor wafer 104 is supported by the supporting members 102. However, by supporting the semiconductor wafer also by the supporting member 102 disposed at the center, it is possible to prevent any warpage of the semiconductor wafer 104 so that more uniform heating of the entire semiconductor wafer 104 is performed.

[0021]

Although the above-described preferred embodiments have exemplified the substrate heating apparatus for the semiconductor wafer, the substrate heating apparatus according to the present invention can be applied to various substrates requiring the heating treatment such as an LCD substrate. Furthermore, although the circular substrate has been exemplified, the substrate heating apparatus according to the present invention can be applied to a polygonal substrate such as a triangular or rectangular substrate.

[0022]

[Effects of the Invention]

As is obvious from the above explanation, according to the present invention, since the support member is fixed to the temperature adjuster, it is possible to prevent the support member from being drawn or floated and the

substrate from being inclined, and consequently, the member to be adjusted in temperature can be uniformly heated. Furthermore, since the peripheral edge of the member to be adjusted in temperature is supported, the member to be adjusted in temperature can be substantially uniformly heated. Moreover, since the recess for containing the support member therein is not opened, there has never arisen any problem that refuse or the like is accumulated. Additionally, since the support member is disposed in the temperature adjuster in loose engagement, it is possible to prevent any damage on the support member due to the difference in expansion coefficient at the time of heating.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig. 1]

Fig. 1 is a plan view showing a preferred embodiment according to the present invention.

[Fig. 2]

Fig. 2 is a cross-sectional view showing the preferred embodiment shown in Fig. 1, taken along a line A-A.

[Fig. 3]

Fig. 3 is a plan view showing essential parts in the preferred embodiment according to the present invention.

[Fig. 4]

Fig. 4 is a cross-sectional view showing essential

parts in another preferred embodiment according to the present invention.

[Fig. 5]

Fig. 5 is a cross-sectional view showing a further preferred embodiment according to the present invention.

[Fig. 6]

Fig. 6 is a plan view showing a still further preferred embodiment according to the present invention.

[Fig. 7]

Fig. 7 is a plan view showing the prior art.

[Fig. 8]

Fig. 8 is a cross-sectional view showing the prior art.

[REFERENCE NUMERALS]

101 ... temperature adjuster

104 ... semiconductor wafer (member to be adjusted in temperature)

102 ... support member

102a ... embedded portion

102b ... projecting portion

403, 403a ... containing portion

(5)

TEMPERATURE ADJUSTING EQUIPMENT

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Abstract

PROBLEM TO BE SOLVED: To enable uniform treatment by practically uniformly adjusting the temperature of a substrate.
SOLUTION: A semiconductor wafer 104 is retained by three retainers 102 arranged in the vicinity of the periphery of a temperature adjusting body 101, and subjected to heat treatment. The retainer 102 consists of a buried part 102a which is buried in the temperature adjusting body 101, and a protruding part 102b formed at the center of the buried part 102a. Since the semiconductor wafer 104 is mounted on the protruding parts 102b, the wafer is heated at a high temperature by the protruding parts, and other parts are uniformly heated. Further heat treatment is enabled without contamination.

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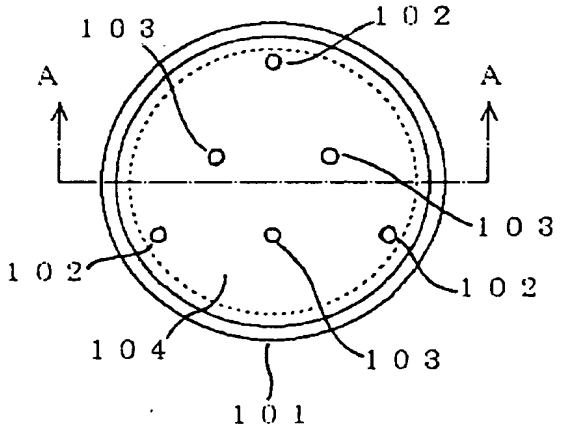
(54)【発明の名称】　温度調整装置

(57)【要約】

【課題】基板を実質的に均一に温度調整して、均一な処理を行う。

【解決手段】半導体ウエハ１０４は、温調体１０１の周辺部近傍に設けられた３個の支持部材１０２により支持され加熱処理が行われる。支持部材１０２は温調体１０１に埋設される埋設部１０２ａと、埋設部１０２ａの中心に設けられる突出部１０２ｂとからなり、半導体ウエハ１０４は突出部１０２ｂ上に載置されるため、突出部１０２ｂにより高温に加熱されるが、それ以外の部分は均一に加熱され、しかも、汚染がなく加熱処理がなされる。



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【特許請求の範囲】

【請求項１】所定温度に設定可能な温調体と、前記温調体に設けられ、被温調体を支持して前記被温調体を前記温調体と非接触に保持する複数の支持部材とを備えた温度調整装置において、前記支持部材は前記温調体に埋設される埋設部と、前記温調体表面から突出する突出部とを備えたことを特徴とする温度調整装置。

【請求項２】前記支持部材は前記被温調体の周縁部を支持する位置に配設されることを特徴とする請求項１記載の温度調整装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、半導体ウエハ、液晶表示装置（ＬＣＤ）用基板等の基板を温度調整するための温度調整装置に関する。

【０００２】

【従来の技術】従来から、半導体ウエハ、ＬＣＤ用ガラス基板等の基板に加熱処理を施すために種々の加熱装置が使用されている。例えば、半導体製造工程のホトレジスト処理工程においては、半導体ウエハ表面の水分を脱水するため、あるいはウェハ表面に塗布されたレジスト中の溶媒を除去するため等に加熱処理が行われる。加熱方法としては、直接ホットプレート方式、バッチ式熱風加熱方式、マイクロ波方式等があるが、コンパクト化、効率化、サイクルタイム短縮および再現性、均一性の向上の要求のもとに直接ホットプレート方式が主流となっている。

【０００３】しかし、直接ホットプレート方式では半導体ウエハをホットプレートに密着させて、直接加熱するため、ホットプレートと半導体ウエハとの密着状態によって熱の均一性に大きく影響する他、一般にホットプレートがアルミニウム等の金属から成るため、重金属汚染、半導体ウエハの裏面へのパーティクルの付着等の問題がある。

【０００４】このような問題を除去するためホットプレートと半導体ウエハとの間に僅かな間隙を設け、直接半導体ウエハをホットプレートに密着させずに加熱処理を行うプロキシミティ方式がある。このようなプロキシミティ方式の加熱装置は、図６、図７に示すように、内部にヒータが内蔵されたホットプレート７０１を備え、ホットプレート７０１の中央部付近には３個の直方形状の凹部７０５が設けられており、各凹部７０５内に基板支持用のセラミック製の球７０２が、ホットプレート７０１上面から僅かに突出するように配設されている。また、ホットプレート７０１の中央部付近には、半導体ウエハ７０４をホットプレート７０１に載置あるいはホットプレート７０１から搬出するために、基板支持ピン（図示せず）が出入りするための支持ピン用孔７０３が設けられている。

【０００５】以上のように構成された加熱装置において

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は、先ず、基板支持ピンを支持ピン用孔７０３を介してホットプレート７０１上部へ突出させた後、基板支持ピンに半導体ウエハ７０４を載置する。次に、基板支持ピンをホットプレート７０１下部へ収容することにより半導体ウエハ７０４を球７０２上に載置し、加熱処理を行なう。このとき、球７０２は、ホットプレート７０１の上面から僅かに突出しているため、即ち、半導体ウエハ７０４とホットプレート７０１との間には微小な間隙が存在するため、半導体基板７０４にはパーティクル汚染等が生じず又、効率良く加熱することが可能となる。

【０００６】

【発明が解決しようとする課題】ところで、球７０２は、凹部７０５内に固定することなく配設されているため、ホットプレート７０１の清掃時や半導体ウエハ７０４の取外し時等に球７０２が凹部７０５から抜出たり、浮き上がったりすることがあり、この状態で半導体ウエハ７０４を載置するとホットプレート７０１の上面に対して傾斜してしまうため加熱が不均一になるという問題があった。

【０００７】また、前述した基板加熱装置においては、球７０２がホットプレート７０１の中央部付近に配設されている。半導体ウエハ７０４は球７０２を介してホットプレート７０１に接することになるため、その中央部付近はその他の部分よりも高温に加熱されてしまう。そのため、半導体ウエハ７０４の面内の温度分布が不均一になるという問題があった。特に、レジストパターンを硬化させるポストベーキングの場合、レジストパターンに対応する部分の温度が高くなりすぎるとレジストパターンの厚みや形状が部分的に変化してしまうという問題があった。

【０００８】本発明は半導体ウエハ、ＬＣＤ等の加熱処理が必要な基板においては、基板を均一に温度調整することが可能な温度調整装置を提供する。更に、本発明は、半導体ウエハ７０４に形成される集積回路（ＩＣ）は、通常、半導体ウエハ７０４の周縁を除いた部分の全面に形成され、レジストパターン等の本来的に均一に加熱すべき主要部分がその周縁を除く部分に配設されていることに着目してなされたものであり、実質的に基板を均一に温度調整することが可能な温度調整装置を提供することを目的としている。

【０００９】

【課題を解決するための手段】上記目的を達成するため、本発明の温度調整装置は、所定温度に設定可能な温調体と、温調体に設けられ、被温調体を支持して被温調体を温調体と非接触に保持する複数の支持部材とを備えた温度調整装置において、支持部材は温調体に埋設される埋設部と、温調体表面から突出する突出部とを有するものであり、好ましくは、支持部材は、被温調体の周縁部を支持する位置に配設されるものである。

【００１０】支持部材は、埋設部が温調体に埋設される

ため、温調体から抜出たり、浮き上がったりしない。このため、支持部材に支持される被温調体が傾斜することがなく、被温調体を均一に温度調整することができる。また、複数の支持部材を用いて被温調体をその周縁部で支持することにより、被温調体を実質的に均一に温度調整することができる。

【００１１】

【発明の実施の形態】以下、本発明の温度調整装置を、半導体ウエハのアドヒージョン処理、プリベーキング処理、ポストベーキング処理等の加熱処理に利用される基板加熱装置に適用した一実施例について、図面を参照して説明する。基板加熱装置は、図１、図２に示すように、円形の温調体１０１を有し、温調体１０１は、内部に電熱ヒータ等の加熱温度の調整が可能な加熱部材（図示せず）を内蔵している。尚、温調体１０１の加熱温度および加熱時間は、処理の目的に応じて種々に設定できる。例えば、アドヒージョン処理の場合には、約８０乃至１００℃で約３０秒間の加熱を行なう。プリベーキングの場合には、約１２０乃至１５０℃で１分間の加熱を行なう。ポストベーキングの場合には、約１２０乃至１５０℃で約１分間の加熱を行なう。冷却を行なうクーリングの場合には室温（例えば２３℃）に制御される。温調体１０１には、被温調体である半導体ウエハ１０４を温調体１０１に載置あるいは温調体１０１から搬出するときに使用するために、基板支持ピン（図示せず）が出入りするための支持ピン用孔１０３が設けられている。

【００１２】このような温調体１０１の周縁部には、半導体ウエハ１０４を支持するための３個の支持部材１０２が設けられている。支持部材１０２は、半導体ウエハ１０４の裏面の汚染を防止するため、セラミック製等が好ましい。支持部材１０２は、図３、図４に示すように、円盤状の埋設部１０２ａと、円盤状の埋設部１０２ａの中心に突出して設けられる突出部１０２ｂとを有する。

【００１３】一方、温調体１０１には収納部である凹部４０３が、温調体１０１上に載置される半導体ウエハ１０４の周縁部に対向する位置に形成される。支持部材１０２の円盤状の埋設部１０２ａは凹部４０３内に収納され、凹部４０３の側壁に設けられたネジ部４０４と螺合するナット４０２により固定される。突出部１０２ｂの先端は温調体１０１の上面から0.1乃至0.3mm程度突出した位置にある。このため、突出部１０２ｂ上に載置される半導体ウエハ１０４と、温調体１０１間には、突出部１０２ｂの先端の突出分の間隙が保持される。尚、前述の固定は、ナット４０２をネジ込む代りに、材質ＰＴＦＥ等の樹脂性のリング状部材を凹部に圧入取着して、支持部材１０２を固定するようにしてもよい。

【００１４】更に、図５に示すように、温調体１０１に設けられる凹部４０３ａは、支持部材１０２の埋設部１０２ａを遊嵌するように形成する。凹部４０３の大きさは、温調体１０１の形成材料と、支持部材１０２の形成材料の膨張係数の相違により、加熱時に膨張する体積の差を吸収できる大きさとすればよい。支持部材１０２の埋設部１０２ａを収納した後、前述したように凹部４０３の側壁に設けられたネジ部４０４とナット４０２により、支持部材１０２を固定することができる。このとき、ナットに形成される支持部材１０２の突出部１０２ｂを貫通させる孔は、突出部１０２ｂの外径より大きく設け、突出部１０２ｂを遊嵌させるようにしてもよい。

【００１５】また、支持部材１０２を固定するには、凹部４０３ａの部分のみでなく、温調体１０１の全面を覆うような円盤状の蓋体４０２ａとし、それぞれの突出部１０２ｂに対応する位置にその先端を遊嵌して突出させる孔を穿設し、蓋体を温調体１０１に固定するようにしてもよい。支持部材１０２を遊嵌させることにより、膨張率の相違から温調体１０１と支持部材１０２の増加する体積が加熱時に異なることによる支持部材１０２の損傷を防止することができる。

【００１６】以上のように構成された基板加熱装置の動作を以下に説明する。処理前の半導体ウエハを送り出すセンダあるいは半導体ウエハにフォトレジストを塗付するコータ等の処理装置から搬送された半導体ウエハ１０４は、搬送機構（図示せず）により先ず、支持ピン用孔１０３を介して温調体１０１上部へ突出した３本の基板支持ピン上に載置される。

【００１７】次に、各基板支持ピンは温調体１０１下部へ収容され、これにより半導体ウエハ１０４が支持部材１０２の突出部１０２ｂ上に載置される。この状態で、温調体に内蔵された電熱ヒータにより半導体ウエハ１０４を加熱処理する。尚、加熱温度及び加熱時間は前述したように処理の種類によって種々に設定される。突出部１０２ｂの先端は、温調体１０１の上面から約0.1乃至0.3mm程度突出しているため、即ち、半導体ウエハ１０４と温調体１０１との間には約0.1乃至0.3mm程度の間隙が存在するため、半導体基板１０４にはパーティクル汚染等が生じず又、効率よく加熱することが可能となる。

【００１８】このとき、各支持部材１０２は温調体１０１の周縁部近傍に配設されているため、半導体ウエハ１０４は、その端部近傍が各支持部材１０２により支持されることになる。したがって、半導体ウエハ１０４の端部近傍における支持部材１０２周辺部分は、それ以外の部分に比べて高温に加熱されるが、ＩＣは半導体ウエハ１０４の端部より内側に設けられているため、ＩＣが設けられている部分は加熱台からの放射熱等により均一に加熱されることになり、半導体ウエハ１０４を実質的に均一に加熱することが可能となる。

【００１９】前述のようにして加熱処理された半導体ウエハ１０４は、支持ピン用孔１０３から基板支持ピンを温調体１０１上部へ突出させることにより、温調体１０１から外され、次の工程へ搬送される。更に、本発明の

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他の実施例として、図６に示すように、温調体１０１の中央部に支持部材１０２を設けたものであってもよい。尚、支持部材１０２の先端部すなわち半導体ウエハ１０４との当接部は、出来る限り細くするのがパーティクル付着、加熱の均一性の点で好ましい。

【００２０】半導体ウエハ１０４の直径が例えば８インチ程度の大形のものになると、その端部近傍のみを支持部材１０２により支持した場合、半導体ウエハ１０４が撓み、その中央部が温調体１０１に接し、パーティクル等により汚染されるおそれがある。しかしながら、中央部に設けた支持部材１０２により半導体ウエハを支持することにより、半導体ウエハ１０４の撓みを防止することが可能となり、半導体ウエハ１０４全体がより均一に加熱されることになる。

【００２１】尚、前述した実施例は、半導体ウエハ用の基板加熱装置の場合であるが、ＬＣＤ基板等の加熱処理が必要な種々の基板の場合にも利用できる。また、円形の基板の例で説明したが、三角、四角等の多角形の基板の場合にも利用できる。

【００２２】

【発明の効果】上記の説明からも明らかなように、本発明によれば、支持部材を温調体に固定することにより、支持部材が抜出たり、浮き上がったりすることがなく、基板が傾斜することを防止することができるので、被温＊

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＊調体を均一に加熱することができ、また、被温調体の周縁部を支持するため、被温調体を実質的に均一に加熱することが可能となる。また、支持部材を収納するための凹部は開口して設けていないため、ゴミ等が貯まるという問題は生じない。更に、支持部材を温調体に遊嵌して設けたため、膨張率の相違から加熱時に支持部材が受ける損傷を防止することができる。

【図面の簡単な説明】

【図１】本発明の一実施例を示す平面図。

【図２】図１に示す一実施例のＡ－Ａ断面図。

【図３】本発明の一実施例の要部を示す平面図。

【図４】本発明の他の実施例の要部を示す断面図。

【図５】本発明の他の実施例を示す断面図。

【図６】本発明の他の実施例を示す平面図。

【図７】従来例を示す平面図。

【図８】従来例を示す断面図。

【符号の説明】

１０１・・・温調体

１０４・・・半導体ウエハ（被温調体）

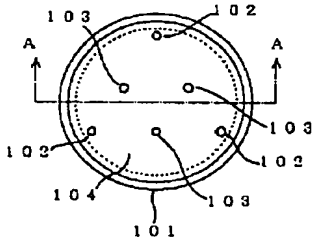
１０２・・・支持部材

１０２ａ・・・埋設部

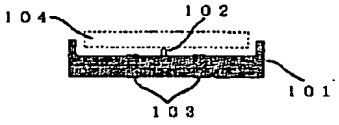
１０２ｂ・・・突出部

４０３、４０３ａ・・・収納部

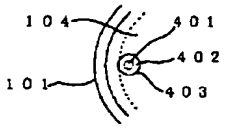
【図１】



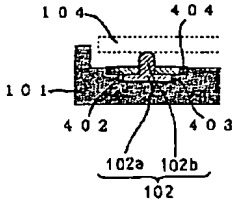
【図２】



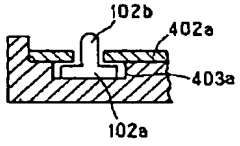
【図３】



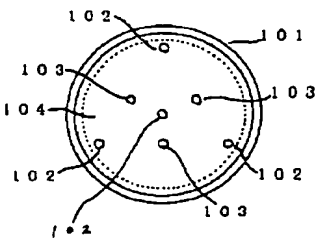
【図４】



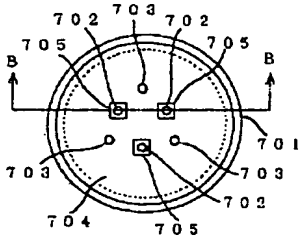
【図５】



【図６】



【図７】



【図８】